# NDT NEWS

## From the NDT Center of Excellence

**April 1999**

☆ In this issue: *Testing Tips* *Maintenance Info* *Standards* ☆

## FROM THE NDT CENTER OF EXCELLENCE MANAGER:

Commanders, please ensure this newsletter is getting down to your nondestructive test personnel. Recent trips to the field have indicated some nondestructive test technicians are not receiving copies of the quarterly newsletter. The newsletter is currently the only way the Nondestructive Testing (NDT) Center of Excellence can get the latest to the field. As with all correspondence leaving AMCOM, the newsletter is addressed to unit commanders to keep them in the loop. If you need additional copies, let the Center of Excellence know. We'll be happy to provide your unit additional copies.

Questions have come up about the calibration requirements for the Nondestructive Testing Equipment (NDTE). According to the Test, Measurement, and Diagnostic Equipment (TMDE) Activity, the NDTE requires no calibration.

We are planning on hosting a weeklong NDT Refresher Course in the June-July timeframe. The course would include all new methods of NDT. An eight-hour radiation course will be held to meet the annual requirements for radiography training. It should be a fun and educational week. Travel and Lodging will be at the unit's expense. If you are interested in attending, please let us know so we can make arrangements. Call, fax, or e-mail:

DSN 746-2228, Commercial (256) 876-2228, Fax (256) 842-0572, e-mail suchman-wa@redstone.army.mil.

## BIFILAR WEIGHT INSPECTION PROCEDURE

Unfortunately, there is a mistake in the bifilar weight ultrasonic inspection procedure published in the UH-60 NDT manual, TM 1-1520-265-23. Change 1 (2 October 1998) has an early revamped procedure designed to clear up the verbiage and provide more realistic graphics for users. Collaboration with Sikorsky Aircraft further revised the procedure to be in compliance with Original Equipment Manufacturer (OEM) specifications. The new procedure has less stringent accept/reject criteria. Highlights of the correct procedure are:

* Establishing the highest amplitude calibration signal with the least amount of gain. This requires verifying calibration at more than one location on the weight.

* Setting the reject level at 80 percent FSH. Rejectable indications must meet *amplitude* and *length* criteria.

* Using the 6dB down measuring technique to determine flaw length.

# NDT NEWSLETTER

## RADIOGRAPHY TIPS (T.O. 33B3-3-31-1)

The LPX-160 x-ray system has proven to be very reliable during our NDT fieldings over the past two years. We have had only a few incidents where the equipment was non-operational. As with any new system, we have learned a few things along the way. We believe you will find the following items very useful:

1. When performing the x-ray tube automatic warm up, make sure the cut out in the lead shield is pointing straight up as the tubehead warms up. Failure to do so will channel a scattered radiation beam in excess of the 2 mR/hr limits towards the 2 mR barrier. Remember to keep your exposure As Low As Reasonably Achievable (ALARA).

2. When conducting a radiographic exposure of a main rotor blade on aircraft, the 2 mR barrier will be approximately twice the size of the safety area required by an exposure of the same energy level directed toward the ground. The exposure directed up will cause additional ionizations with the air and increase the required safety perimeter diameter.

3. There is a dormant tube warm up NOTE in the LPX-160 maintenance manual on pages 4-6. If your x-ray tube has not been operated for an extended period or upon pressing the x-ray ON button you receive an immediate ARC message, follow the manual warm up sequence in the NOTE to get your system back online.

## RADIATION SURVEY METERS AND DOSIMETRY CLARIFICATIONS

**SM-400A Survey Meter:** Recent phone calls to the NDT Center of Excellence have revealed some confusion with where and when to send in the SM-400A survey instruments. Per TM 1-1500-335-23, "survey instruments used for only X radiography shall be calibrated once per year as a minimum." The following address is the **ONLY** authorized calibration activity for the SM-400A:

Transportation Office
Central Receiving-Bldg 8022
Redstone Arsenal, AL 35898
M/F TMDE-Bldg 5417
DSN: 746-1302

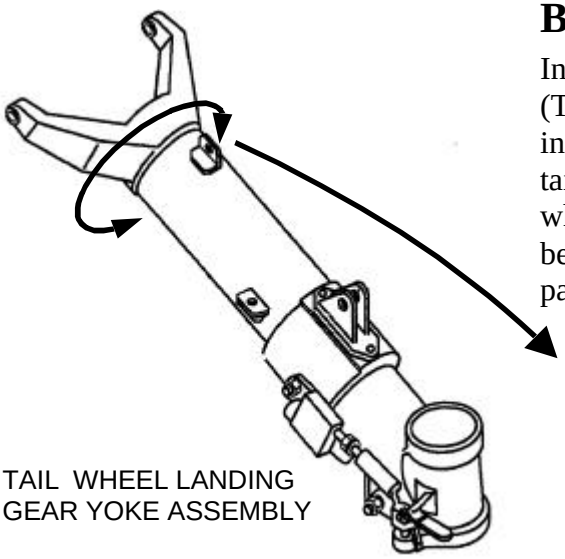
To preclude unnecessary delays, instruments should be shipped directly to the above address.

Rumors prevail that it is illegal to ship or mail the SM-400A with the end cap installed. This statement is **FALSE.** The SM-400A should be shipped with the end cap on to aid in calibration and provide protection for the mylar window. At a minimum, **enclose** the following on a piece of paper in the SM-400 package: U.S. ARMY, TMDE—This package conforms to the conditions and limitations specified in 49 CFR 173.424 for radioactive material, excepted package-instruments or articles, UN 2910.

**Electronic Personnel Dosimeter (EPD2):** The EPD2 dosimeter requires an annual calibration. The calibration facility will install a new battery and reset the TOTAL HP (penetrating) and HS (surface) dose to zero. The U.S. Army TMDE Activity at Redstone is the **ONLY** authorized calibration laboratory. (See above address.)

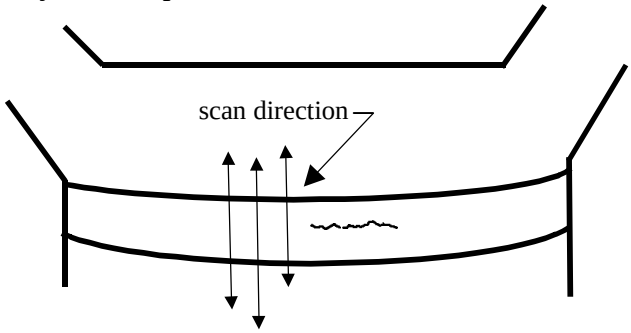
# NDT NEWSLETTER

## BLACKHAWK TAIL WHEEL STRUT



TAIL WHEEL LANDING GEAR YOKE ASSEMBLY

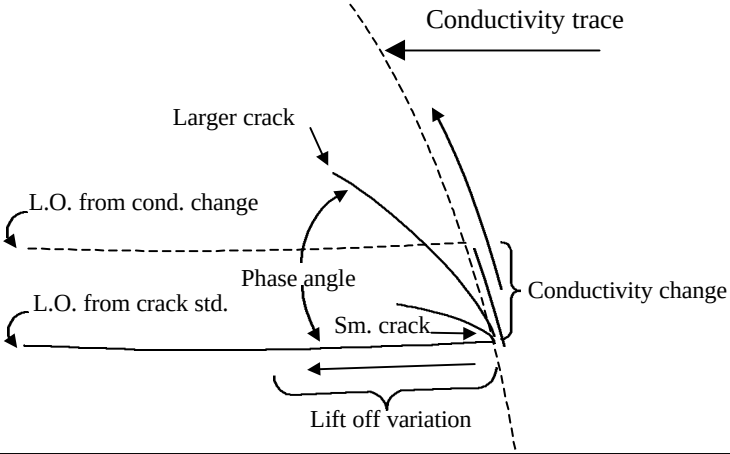
In addition to the typical crack locations depicted in the UH-60 NDT manual (TM 1-1520-265-23), Ft. Rucker NDT inspectors have detected a high incident rate of circumferential cracks developing in the upper radius of the tail wheel landing gear yoke. NDT inspectors should be mindful of this area when performing inspections on the yoke assembly. Visual indication can be nonexistent through the Chemical Agent Resistant Coating (CARC) paint hiding potentially catastrophic flaws.




Scanning a tight radius area can be a little difficult to accomplish considering the probe angle adjustments required as you scan **<u>across</u>** the radius and index circumferentially. Trying to keep a consistent signal display will challenge your dexterity. Due to the heavy nature of CARC paint, the probe's balance point (null point) can vary considerably from the calibration standard. Null the probe near the machined radius to get a balance point which more closely resembles the inspection area. Heavy nonconductive coatings may require adjustments to the instruments phase angle and gain settings. By placing a piece of paper across the calibration standard and THEN nulling, you will provide a balance point for the probe more reminiscent of the lift off from the CARC paint on the yoke assembly.

## IMPEDANCE PLANE ANALYSIS (TM 1-1500-335-23, PG. 4-26)

Impedance plane analysis allows the NDT operator to determine multiple material property characteristics by analyzing the behavior of the flying dot on the CRT display. With a common crack detection set up on the CRT, an experienced operator can determine a changing thickness in nonconductive coatings, a conductivity change in the base material, and approximate flaw size (crack signal amplitude and direction “phase” as affected by the volume of the crack).



# NDT NEWSLETTER

## EDDY CURRENT QUIZ (TM 1-1500-335-23)

1. A material which is annealed will have which material property enhanced? pg. 4-79
   a. conductivity
   b. solubility
   c. strength
   d. corrosion resistance

2. The amplitude and phase of the signal received from a crack on the CRT display: pg. 4-70
   a. is related to the depth of the crack
   b. is related to the length of the crack
   c. is related to the volume of the crack
   d. both a and b

3. Which of the following is not a material property that influences eddy current generation? pg. 4-6
   a. electrical conductivity
   b. magnetic permeability
   c. probe frequency
   d. geometry

4. The varying magnetic field generated from the AC current flowing through the eddy current test coil: pg. 4-5
   a. varies at the same rate as the AC electrical current
   b. varies at one half the rate of the AC current
   c. varies with the amount of current flowing through the test coil
   d. a and c

5. Impedance is the total opposition to current flow and is a two dimensional parameter consisting of: pg. 4-18
   a. phase and amplitude
   b. inductance and resistance
   c. vector's X and Y
   d. conductivity and permeability

6. Which variable is not used to define the standard depth of penetration of eddy currents? pg. 4-16
   a. conductivity
   b. magnetic permeability
   c. frequency
   d. magnetic coupling

7. The rate of deflection or the rapidity of response on the CRT display for a conductivity or gradual thickness change would be: pg. 4-70
   a. quick like a crack response
   b. dependent upon the instruments refresh rate
   c. slow and gradual
   d. a and b

8. A sound rule of thumb for eddy current test capabilities could be: pg. 4-53
   a. cracks more than 2 X the probe diameter are difficult to detect
   b. the faster you scan the less you'll see
   c. cracks less than ½ the probe diameter are difficult to detect
   d. bigger isn't always better

9. Absolute, differential, and reflection are all common eddy current coil configurations. pg. 4-28
   a. true
   b. false

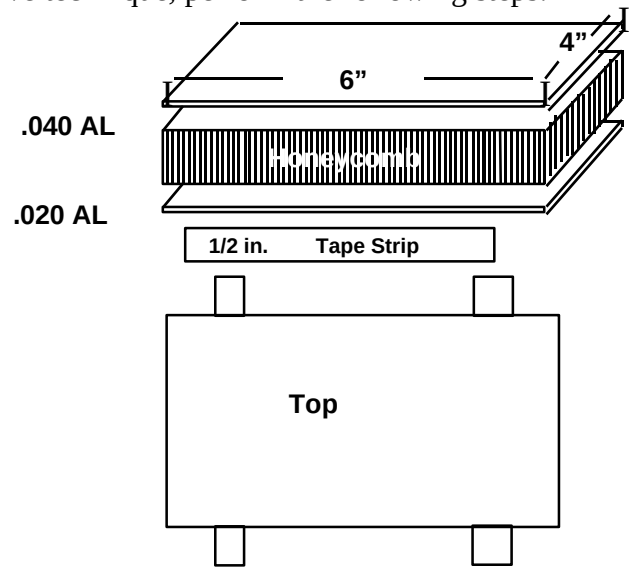
10. An increase in operating frequency will cause the impedance of the probe when on the test specimen to change, thereby causing the material's balance point to: pg. 4-28
    a. travel down the conductivity curve
    b. travel up the conductivity curve
    c. stall out
    d. remain stationary

# NDT NEWSLETTER

## HARMONIC BOND TESTING

***If you have not made a Bond Test standard yet, this is a reminder to make it now.*** To properly perform a bond test inspection, an accurate calibration standard is required. The Prepreg Graphite standard provided with your Bondmaster is not equivalent to aluminum sandwich panel construction. Although you may have used it and it worked, your level of proficiency and integrity will increase using the appropriate standard for the material configuration you are inspecting. For a successful alternative technique, perform the following steps:

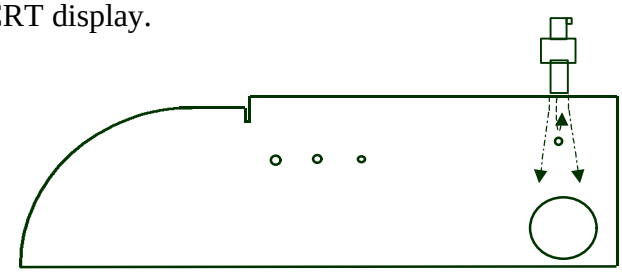
1. Cut two Teflon tape strips six inches long. The one-inch Teflon tape is provided with your Bondmaster.
2. Fold strips in half, sticky side together, forming a pull strip the width of your test panel plus two inches. The extra two inches allow you to pull the strip from the bonded panel before the adhesive completely cures.
3. Apply the adhesive to the aluminum skin per normal practice.
4. Position the Teflon pull strip between core and skin, one on the .040 side and one on the .020 side.
5. Attach the "buttered" skin on top of the core and apply moderate pressure throughout the curing time.
6. Remember to pull the strip from the panel prior to the adhesive completely curing.



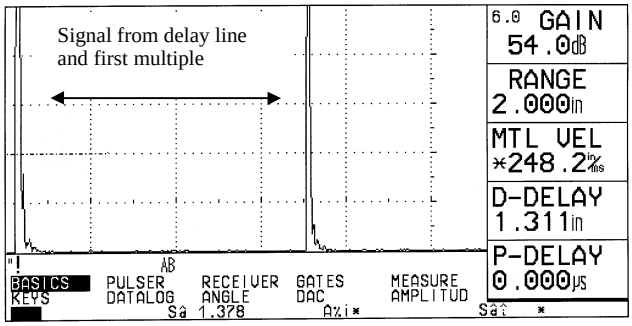

The MIA bond test mode monitors component stiffness. Leaving the strip "in" will create a more rigid area in your standard. Removing the strip before the adhesive cures creates a more realistic skin-to-core unbond than the condition created by back drilling composite panels. Refer to Appendix C in any NDT manual for the appropriate materials to be used for this standard.

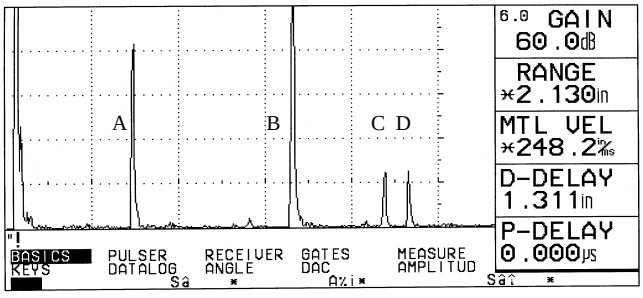
## ULTRASONIC CHECKUP

The upper ultrasonic screen display is from a 15 Mhz transducer with a ¼ in. delay line attached. The first signal is from the delay line; the second is a multiple. Review the sketch below and interpret the lower CRT display.



A- Reflection from side drilled hole
B- Multiple from delay line
C- Lucite plug
D- Multiple from side drilled hole

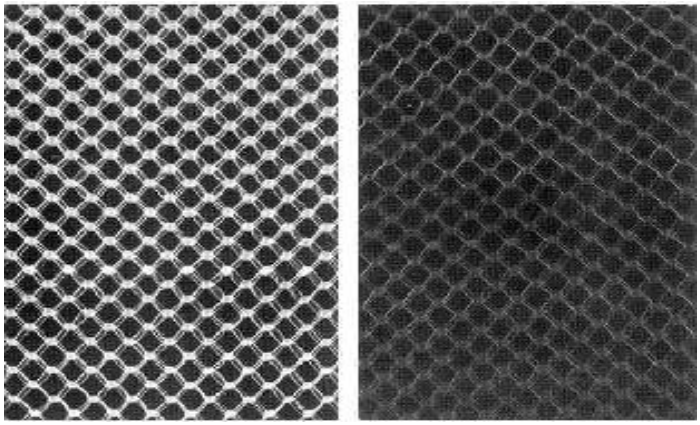


# NDT NEWSLETTER

## RADIATION ENERGY

The radiation energy chosen kV must be compatible with the absorption of the subject material. For low absorption materials, low radiation produces final radiographic images with good contrast. Conversely, for inspection of thick, highly-absorbing materials, the radiation must have sufficient penetrating capability to produce an image within a reasonable period of time. Below are images of a low absorbing honeycomb panel. The right image was made at high kV, 80 kV, 5 sec. The left image was made at low kV, 38 kV, 5 min. All other parameters were held constant. This shows the effect of contrast due to kV. Which one would you rather claim you shot?



## CONSTANT EXPOSURE CHART

A quick and semi-accurate way of developing an exposure chart for a particular material and specific conditions uses the step wedge. The most common exposure chart is the **constant density chart**. The following steps will assist you in developing an exposure chart for your specific radiographic conditions:

1. Make an exposure at an energy level that would normally be used, and determine which step has the desired density (2.0).

2. Make another exposure by increasing or decreasing the TIME ONLY to produce the same density on a step with a different thickness value.

3. Plot the time (MAS) and material thickness of the step with the 2.0 density on a piece of semi-logarithmic paper. Reference the TM 1-1500-335-23. Draw a line through the points and label with the kV used.

**STEPPED WEDGE**

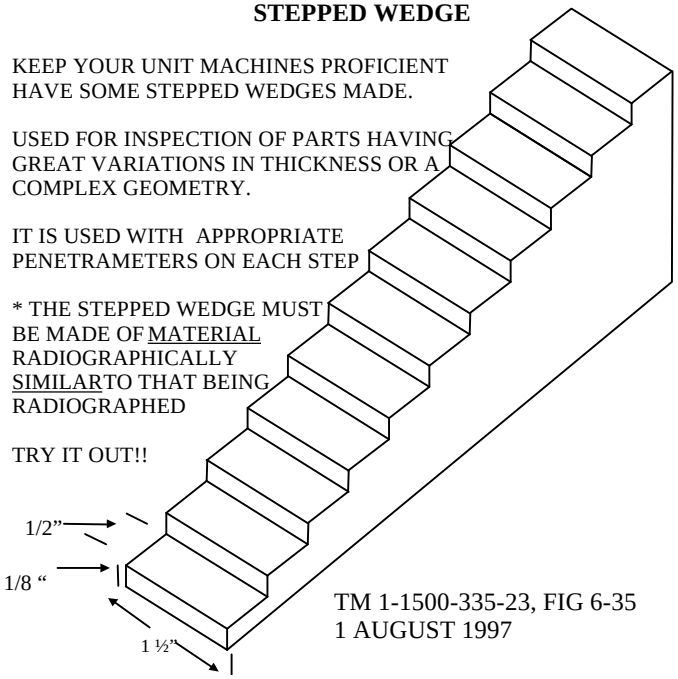
KEEP YOUR UNIT MACHINES PROFICIENT HAVE SOME STEPPED WEDGES MADE.

USED FOR INSPECTION OF PARTS HAVING GREAT VARIATIONS IN THICKNESS OR A COMPLEX GEOMETRY.

IT IS USED WITH APPROPRIATE PENETRAMETERS ON EACH STEP

* THE STEPPED WEDGE MUST BE MADE OF MATERIAL RADIOGRAPHICALLY SIMILAR TO THAT BEING RADIOGRAPHED

TRY IT OUT!!




TM 1-1500-335-23, FIG 6-35
1 AUGUST 1997

# NDT NEWSLETTER

## TECHNICAL ASSISTANCE VISITS

The Center of Excellence has completed technical assistance visits requested by the 404th DASB, Ft. Hood, TX, and the Mississippi AVCRAD, Gulfport, MS.

Assistance visits are scheduled for Ft. Drum, NY, and the Connecticut AVCRAD, Groton, CT.

If your unit needs assistance in any NDI method, request it from the NDT Center of Excellence.

## RADIATION PROTECTION OFFICER'S COURSE (RPO)

There will be an Army Material Command (AMC) sponsored RPO course at Ft. Belvoir, VA, 19-30 July 1999.

There is no cost for course attendance, but the unit must fund transportation and per diem.

DD Form 1556 must be submitted prior to arrival for course attendance.

Call Christy Koloszar at DSN 654-1980 or commercial (703) 704-1980 for more information.

COMMANDER
AMCOM
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First Class